Expected Impacts to Coal Combustion Product Utilization (Risks, Landfilling, and Costs) From Mercury Sorbent Materials

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2001 WE Coal Ash Production

- **Fly Ash = 569,744 tons**
- **Bottom Ash = 129,627 tons**
- **Total = 699,371 tons**

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2001 CCP's Utilization (Tons)

• Concrete	237,000
• Waste Stabilization	116,000
• Sub-Base (Btm. Ash)	76,000
• Supplemental Fuel	70,000
• Landfill Applications	37,000
• Cement Raw Feed	23,000
• CLSM Flowable Fill	19,000
• Reclaimed Ash Material	9,000
• Soil/Asphalt Stabilization	6,000
• Miscellaneous	1,000

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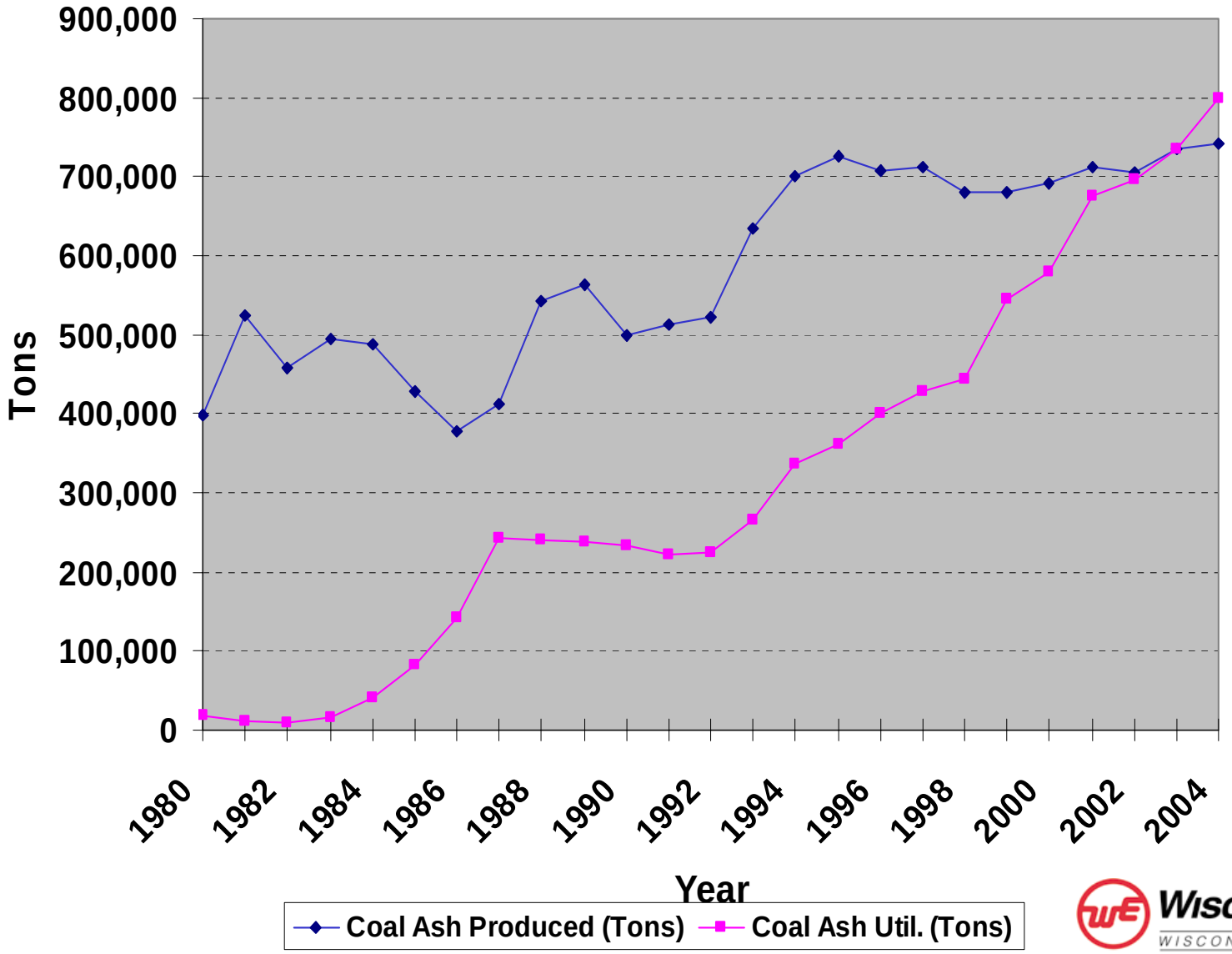
WE Coal Ash Production & Utilization



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2001 Ash Utilization

- WE Ash Utilization in Wisconsin is 97%
- The National Average is 32%

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Effects of Carbon in Fly Ash for Concrete

- Organic Contaminant
- Affects Freeze/Thaw Durability
- Admixture Quantities
- Color
- Water Demand & Strength

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Predicted Carbon in Ash

Injection Concentration (lbs/Mmacf)	Injection Rate (lbs/h)	PAC in Ash (%)
10	340	4.3
5	170	2.2
2	70	0.9
1.1	40	0.5

American Society of Testing and Materials
ASTM C618

- Puts a 6% limit on carbon content in concrete
- Yet 1% is the real world limit

- The key is consistency - to manage risk and minimize liability

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ASTM C618 P4 Results

- LOI Changed from O.6% to
  - A range of 1.0 to 3.6%
- Strength Activity Changed from 91.3% to
  - A range of 84.1 to 86.8%
- Specific Gravity Changed from 2.58 to
  - 2.56 to 2.49
- No significant change in other parameters

Foam Index Testing Method

- Set amount of cement, fly ash and water or fly ash and water are introduced into a jar, capped and shaken
- Diluted drops of concrete air entraining admixture are added in small increments and shaken after each addition
- Determine how many drops are required to produce a stable foam on the surface
- The number of drops is the foam index

Carbon in Ash
Foam Index Results

Salable Contract Limit is 25 Drops

Injection Concentration (lbs/Mmacf)	Unburned Carbon in Ash (%)	Foam Index (Drops)	Comment
0	0.55	15	Normal
1	1.1	>72	Maxed out
3	1.6	>72	Maxed out
10	3.6	>72	Maxed out

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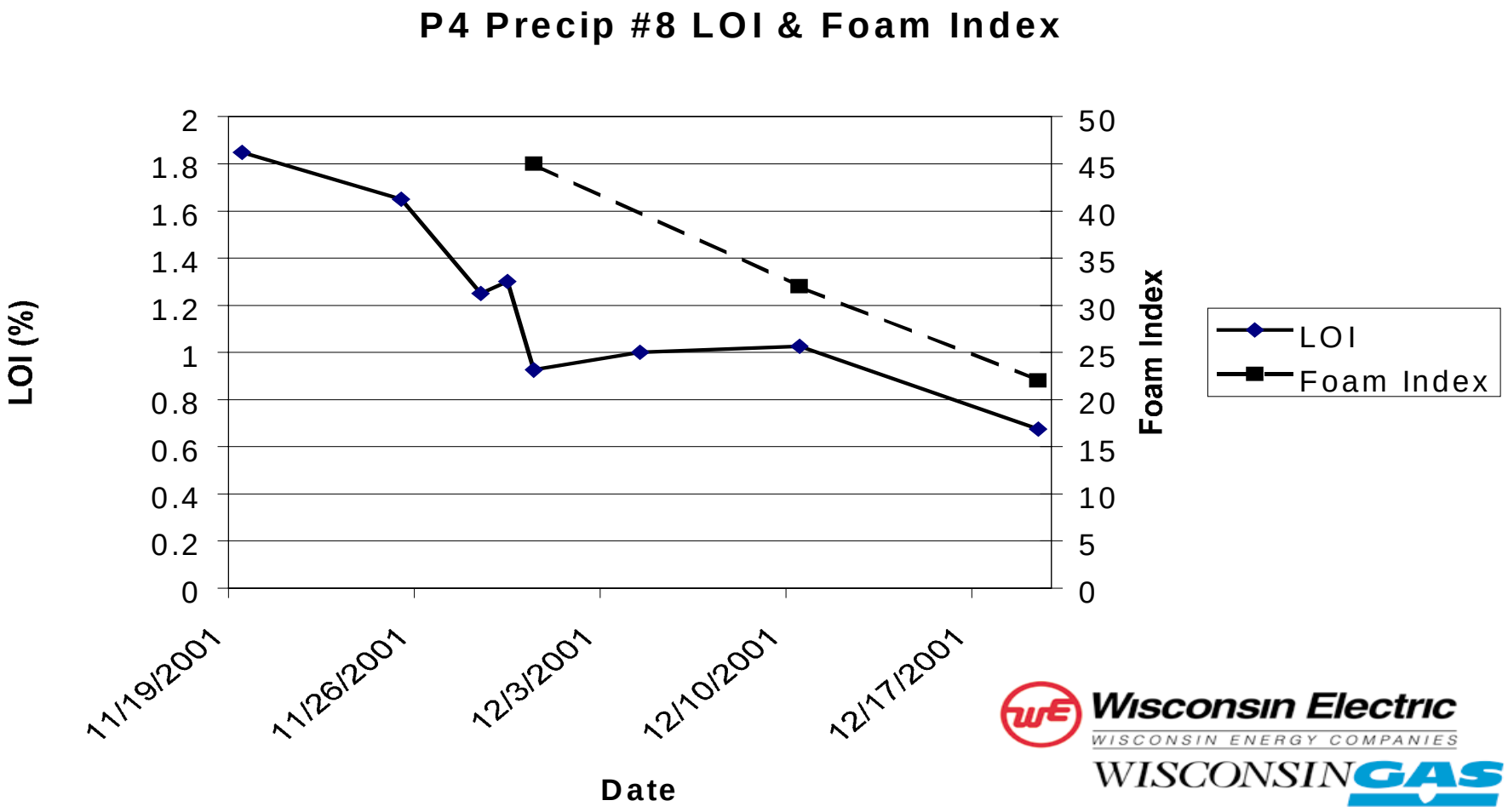
Residual Carbon Effects

Testing Concluded on 11/15/01



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Fly Ash
Mercury Content (Bulk)

- Normal = 0.13 ppm

- Low Sorbent = 0.74 ppm (0.48-0.93)
- Medium Sorbent = 0.85 ppm (0.80-0.91)
- High Sorbent Hg = 0.95 ppm (0.84-1.00)

- NR 538 (Category 1) = Less than 4.7 ppm

Fly Ash
Mercury Content (Leach)

- Normal = Less than 0.000028 mg/l

- Low Sorbent = 0.000033 mg/l
- Medium Sorbent = Less than 0.000028 mg/l
- High Sorbent Hg = Less than 0.000028 mg/l

- NR538 (Categ. 1) = Less than 0.0002 mg/l

The Economics of Fly Ash Utilization Versus Disposal

Product Revenue	$10 - $15/ton
Disposal Cost	($30 - $35/ton)
For a difference of	$40 - $50/ ton

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Impact of Hg Control for Pleasant Prairie

Fly Ash - 300,000 tons annually

Lost Revenue per year	$3 - $4.5 Million
Landfill Costs per year	$9 - 10.5 Million
Annualized Costs for Redesigned Landfill	$.2 Million
Total	$12 - 15 Million

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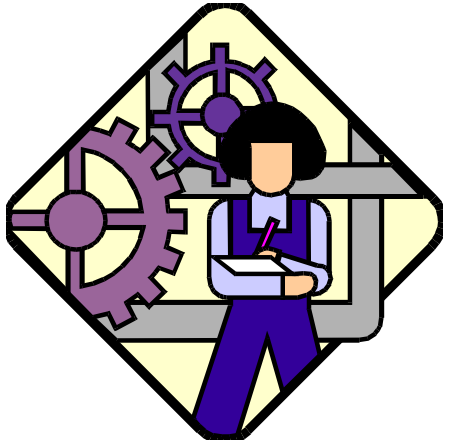
Problems with Existing Carbon Removal Methods

- Wet Process - Froth Floatation
- Ash Fuel
- Chemical Treatments
- Electrostatic Removal



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